



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **NWP412A Investigate and plan the optimisation of activated sludge processes**

**Revision Number: 1**

## **NWP412A Investigate and plan the optimisation of activated sludge processes**

### **Modification History**

Not applicable.

### **Unit Descriptor**

**Unit descriptor** This unit of competency describes the outcomes required to evaluate system performance and investigate and report on optimisation of activated sludge treatment processes in maintaining water quality.

### **Application of the Unit**

**Application of the unit** This unit supports the attainment of skills and knowledge required for technical staff with a specific responsibility for optimising activated sludge treatment processes.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

**Employability skills** This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency. Performance criteria describe the performance needed to demonstrate achievement of the element. Where ***bold italicised*** text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
<b>1 Evaluate activated sludge treatment process performance</b>	<p>1.1 Review existing process performance data against relevant <b><i>organisational or legislative requirements</i></b>.</p> <p>1.2 Review existing operational <b><i>processes</i></b> with reference to <b><i>manufacturers' and plant designers' specifications</i></b>.</p> <p>1.3 Identify the impact of <b><i>influent quality</i></b> on activated sludge treatment processes as required.</p> <p>1.4 Identify and coordinate any additional sampling and <b><i>testing</i></b> required for valid evaluation of current process performance.</p>
<b>2 Investigate activated sludge treatment plant configuration</b>	<p>2.1 Review existing fault reports and other relevant plant asset information.</p> <p>2.2 Investigate the operational status of <b><i>plant components</i></b> with reference to manufacturers' and plant designers' specifications.</p>
<b>3 Investigate the operational options for process optimisation</b>	<p>3.1 Review relevant fault and incident reports and remedial actions taken.</p> <p>3.2 Investigate <b><i>potential changes to operational processes</i></b> to identify possible optimisation strategies.</p>
<b>4 Plan treatment process optimisation</b>	<p>4.1 Determine plant configuration and revised operational processes for process optimisation.</p> <p>4.2 Plan a trial to test the performance of the determined optimisation options.</p> <p>4.3 Compile a report making recommendations on optimisation options.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills:

- investigate and report on operational or control system problems
- coordinate activated sludge and BNR treatment process inspection, sampling and testing
- perform various calculations to provide data for the analysis and development of options and solutions, such as F:M ratio, MCRT, return and wasting rates
- operate control and communication systems
- use safety and personal protective equipment
- communicate with colleagues, consultants and suppliers
- produce optimisation reports
- interpret a range of complex and technical documents, including relevant:
  - regulatory, legislative, licensing and organisational requirements
  - codes and standards
  - specifications
  - organisational policies
- articulate complex ideas clearly
- work collaboratively with relevant stakeholders
- analyse problems and recommend appropriate remedial solutions
- identify and respond to risks and hazards
- identify opportunities for improved water management
- participate in the provision of appropriate information to inform workplace processes
- manage work priorities
- use information effectively to improve work performance.
- prepare and apply chemical dosing.

#### Required knowledge:

- principles that form the basis of activated sludge treatment processes
- principles that form the basis of biological nutrient removal (BNR) activated sludge treatment processes, such as nitrification and de-nitrification, enhanced biological P removal
- types of activated sludge and BNR activated sludge treatment processes
- activated sludge and BNR microbiology
- selectors
- membrane bioreactors (MBR)
- pH and alkalinity
- pre-fermenters
- chemical and nutrient dosing requirements
- inhibitory substances
- bulking and foaming

**REQUIRED SKILLS AND KNOWLEDGE**

- system layout
- principles of activated sludge and BNR system maintenance
- control and communication systems
- relevant historical records
- range of appropriate measuring and testing procedures
- investigation procedures
- risk management principles related to activated sludge and BNR treatment processes
- relevant legislation, standards and workplace policies and procedures.

# Evidence Guide

## EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### **Critical aspects for assessment and evidence required to demonstrate competency in this unit**

The candidate should demonstrate the ability to evaluate system performance and investigate and report on optimisation of activated sludge treatment processes in maintaining water quality including:

- reviewing existing activated sludge or BNR treatment process performance with reference to historical data, differences in raw water quality and plant configuration
- identifying data deficiencies and organising additional data collection through appropriate sampling and testing
- assessing fault reports and investigating the current operational status of activated sludge or BNR treatment process plant components
- investigating current and potential chemical addition practices
- planning trials to test the performance of the determined activated sludge or BNR treatment process optimisation options
- preparing reports making recommendations.

### **Context of and specific resources for assessment**

Access to the workplace and resources, including:

- documentation that should normally be available in a water industry organisation
- relevant codes, standards and government regulations.

Where applicable, physical resources should include equipment modified for people with disabilities.

Access must be provided to appropriate learning and assessment support when required.

Assessment processes and techniques must be culturally appropriate, and appropriate to the language and literacy capacity of the candidate and the work being performed.

Validity and sufficiency of evidence requires that:

- competency will need to be demonstrated over a period of time reflecting the scope of the role and the practical requirements of the workplace
- where the assessment is part of a structured learning experience the evidence collected must relate to a number of performances assessed at different points in time and separated by further learning and practice

## EVIDENCE GUIDE

- a decision of competence only taken at the point when the assessor has complete confidence in the person's competence over time and in various contexts
- all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
- where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
- assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.

In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in a manner appropriate to the skill levels of the operator and cultural issues that may affect responses to the questions, and will reflect the requirements of the competency and the work being performed.

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. ***Bold italicised*** wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Organisational or legislative requirements*** may include:

- organisational performance standards
- standard operating procedures
- quality assurance
- federal, state and local environmental and water quality legislation.

***Processes*** may include:

- activated sludge treatment processes, such as:
- conventional or extended aeration
- contact stabilization
- high rate
- membrane bioreactor (MBR)
- intermittently decanted extended aeration (IDEA)
- sequencing batch reactor (SBR).
- Biological nutrient removal processes:
- Modified Ludzac-Ettinger (MLE)
- Bardenpho
- University of Cape Town.

***Manufacturers' and plant designers' specifications*** may include:

- food to micro-organism ratio (F:M)
- mean cell residence time (MCRT)
- detention time
- mixed liquor suspended solids (MLSS)
- Biological Oxygen Demand or Chemical Oxygen Demand removal
- nitrogen or phosphorus removal
- suspended solids removal
- intended plant configuration.

***Influent quality*** may include:

- Biological Oxygen Demand or Chemical Oxygen Demand
- pH and alkalinity
- nutrients
- total and suspended solids
- inhibitory compounds, such as heavy metals
- temperature.

***Testing*** may include:

- Biological Oxygen Demand or Chemical Oxygen Demand
- temperature



## RANGE STATEMENT

- nitrogen, such as total nitrogen, ammonia, nitrate and nitrite
  - phosphorus, such as orthophosphate and total phosphorus
  - settling tests
  - pH and alkalinity
  - microscopic observation
  - oxygen uptake rates
  - respiration rates
  - dissolved oxygen
  - redox potential
  - suspended solids, such as total and volatile.
- Plant components* may include:
- valves
  - return and wasting pumps
  - aeration equipment
  - chemical and nutrient dosing equipment
  - decanters
  - sedimentation tanks
  - on-line analysers.
- Potential changes to operational processes* may include:
- Food:Microorganism (F:M) ratio
  - Mean Cell Residues Time (MCRT)
  - Mixed Liquor Suspended Solids (MLSS)
  - return and waste activated sludge rates
  - chemical and nutrient addition
  - pre-treatment to remove inhibitory or toxic substances
  - alkalinity and pH correction
  - mixed liquor recycle rates
  - phase timing in intermittent or batch processes.

## Unit Sector(s)

Not applicable.

## Competency field

Competency field      Treatment